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EXPERIENTIAL LEARNING IN COST ESTIMATING

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Experiential Learning in Cost Estimating

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Summary

This paper investigates experiential learning theory and the current perception of experiential factors in the accuracy of pre-tender cost prediction. It compares the preferred learning styles of a sample of experienced pre-tender cost estimators with those of novice quantity surveyors and investigates how estimators have developed as a result of their experiences. Experiential factors, those which stimulate personal development in pre-tender estimators, are considered and a mechanism to improve the accuracy of pre-tender estimates is proposed linking experiential learning theory with the introduction of feedback and self monitoring systems.

Keywords: Cost estimating, experience, experiential learning, feedback, accuracy, quantity surveyor, expertise.

Introduction

Research in pre-tender estimating practice indicates that 'experience' is a major factor in determining the expertise of the estimator and hence the accuracy of the resulting estimates.

References have been made in the literature to the importance of estimators' "background of experience" (Park 1966), "familiarity with a building type or client" (Morrison & Stevens, 1980; Willis & Ashworth, 1987; Flanagan & Stevens, 1990) and "knowledge acquired through experience" (Ashworth & Skitmore, 1983). In a major study involving sixty estimators in practice (Skitmore *et al*, 1990), it was found that project specific experience was the main factor associated with the accuracy of early stage estimates.

In this paper we consider the nature of experience and its acquisition, and the relevance of learning theories and experiential learning. The results of a study involving a sample of ten experienced practising pre-tender estimators are presented which confirm previous anecdotal evidence that experience is considered to be a vital factor in developing estimating expertise but that little is known of how and what types of experience contribute to the learning process. A further study is described in which the learning style of the estimators is examined by means of Kolb's 'Learning Style

Inventory' and Honey and Mumford's 'Learning Style Questionnaire'. This showed that the preferred learning style of the experienced pre-tender estimator was the Accommodator (after Kolb) and with a very strong preference for the Theorist, Pragmatist and Activist (after Honey and Mumford). An increased utilisation of the Concrete Experience stage and a decreased use of the Reflective Observation stage with time was also found, suggesting that the older practitioners tended to reflect less than their younger counterparts. This was confirmed by the finding that only two of the experienced estimators used formal logging of estimates as an aid to reflection.

Finally a mechanism to improve the accuracy of pre-tender estimates is proposed linking experiential learning theory with the introduction of feedback and self monitoring systems.

Experience

Experience has been defined as the "actual observation of, or practical acquaintance with facts or events, practice in doing something or knowledge or skill gained from this experience (noun) or meet with, feel, find by, undergo or suffer (transitive verb)" (Oxford Dictionary, 1981). There are, therefore, two aspects to experience, the actual participation in an "activity" and the knowledge or learning derived from it.

While a novice has been defined as "a person who is

inexperienced in the work etc. that he or she is doing, a beginner" (Oxford Paperback Dictionary, 1988). Stockley (1987) defines an expert as "... someone who has a deep and proven knowledge in a particular domain where the knowledge represents the expert's range of information about or familiarity with the domain gained by experience... and it ... is this ability to use his practical experience gained in the "real world" to offer a solution which is not only correct but "workable" which gives the consulting of a specialist value". The transition from the position of novice to an expert in pre-tender estimating could be said to be derived from accumulated experience within the field of cost prediction. It is, therefore, the insight and development derived from the experience by the pre-tender estimator that requires further investigation.

Do "expert" pre-tender estimators learn from experience?

The surveys by Grieg (1981), Morrison & Stevens (1980), Skitmore (1985), Ogunlana (1989) and Skitmore *et al* (1990) have all illustrated the perceived importance of the estimator's experience within the quantity surveying profession. Skitmore *et al* (1990) concluded that a "tendency has been noted for the expert estimator to specialise in estimating with the passage of time. The highest levels of presumed expertise has been shown by estimators in the experience range thirty five to forty four years. These observations lead to the conclusion that

acquisition of expertise is thought to be an ongoing process...". As the acquisition of expertise is considered to be an ongoing process it can be deduced that the "expert" pre-tender estimator learns from experience (i.e., "by doing").

Experience and the development of expertise

The consideration of experience as a factor in the development of expertise within cost estimating has, to date, centred primarily on the length of time an estimator has been practising and the types of buildings or projects undertaken. As already stated, however, experience encompasses not only these aspects, but also the reactions of the estimator to these experiences. It has been suggested that fifteen years experience could merely equate 1 years experience repeated 15 times. The full implications of experience on the development of expert pre-tender estimators has not, in our view, been adequately taken into account in previous studies.

The use of effective feedback systems

The use of effective feedback systems is considered to improve the accuracy of pre-tender estimates. Flanagan & Norman (1983) Morrison (1984) and Skitmore & Tan (1988) have all made reference to the use of feedback systems. Likewise experts, it

is suggested, possess strong self monitoring skills. The application of experiential factors would seem to be enhanced where suitable feedback systems are in operation. This appears to be supported by the findings of Ogunlana (1989, 1991) who suggests that estimators are not learning sufficiently from experience due to the absence of a system for monitoring estimating performance. He considers feedback techniques to represent a potential force in improving accuracy and in developing individual expertise.

Who are "expert" pre-tender estimators?

As there is confusion over who "true" expert estimators are, could they be considered to be someone who is prepared to question what they are doing, reflect on their experience, integrate these new assumptions into their existing concepts and then be prepared to experiment when faced with a similar situation in the future? This process could be described as an ability to change ones' perspective when faced with a problem. Since Handy (1990) equates change with learning some insight into the expert may be gained through the theories of experiential learning.

Learning Theory

Learning is, to quote Wilson (1980), "... a cognitive activity that involves the use of intellect for the development and structuring of understanding about oneself and the world in which one lives. Learning is a continuous process of organising and reorganising what is known and believed to be true on the basis of new evidence. This process occurs within the individual, and during this process numerous personal and emotional attributes interact. Additionally, theorists agree that learning culminates in change". While Kolb (1984) defines learning as "the process whereby knowledge is created through the transformation of experience" and occurs " through the active extension and grounding of ideas and experience in the external world and through internal reflection about the attributes of these experiences and ideas".

Experiential Learning

A review of learning theories revealed that several educationalists consider experiential learning to be the most significant aspect in personal development. According to Kemmis et al (1977), learning cannot be considered independently of experience, while Boydell (1976), equates professional competence to the ability to learn from experience. Chickering (1976) defines experiential learning as "the learning that occurs when changes in judgements, feelings, knowledge, or skills result for a particular person from living through an

event or events". Several models of experiential learning have been produced; Table 1 illustrates the names given to these stages. Most experiential learning theories adopt a cyclic model with four distinct and mutually important stages. As Honey and Mumford (1989a) suggest "knowing about different learning style preferences is the key to understanding and to becoming more effective at learning from experience". Gibbs (1988) clarifies the process as follows:

1. "Learners are involved in an active exploration of experience.
Experience is used to test out ideas and assumptions rather than to obtain practice passively. Practice can be very important but it is greatly enhanced by reflection.
2. Learners must selectively reflect on their experiences in a critical way, rather than take experience for granted and assume that the experience on its own is sufficient.
3. The experience must matter to the learner. Learners must be committed to the process of exploring and learning.
4. Openness to experience is necessary for learners to have the evidence upon which to reflect".

Reflection

One of the key processes in learning from experience Boud *et al* (1985) suggest is reflection which they define as "a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations". The importance of the reflective stage of the learning cycle is supported by Maclean (1987) who suggests that it acts as a "naming or labelling activity". This theme is echoed by Gibbs (1988) who considers that "... it is not sufficient simply to have an experience in order to learn. Without reflecting upon this experience it may quickly be forgotten or its learning potential lost". Reflection should lead therefore to a change i.e., modification (Pedler *et al*, 1986) or reframing (Boxer, 1985; Handy 1990). While all four elements of the cycle are necessary for progression it is often the area of reflection, for the busy practitioner, that becomes neglected. Due to pressure of work tasks are performed in the "traditional" or "normal" manner resulting in little or no reflective thought and, therefore, no experimentation. This supposition is further supported by the research of Garratt (1987) whose experience with directors has shown that "... they shy away from the reflection quadrant... their most common model of learning seemed to be action, observation, hypothesis" and Casey (1983) who has pointed out "one condition for learning which is not necessarily present in a manager's working life... is the regular opportunity to pause and reflect before having another go".

Openness to experience

According to Pedler et al (1986) "if the learner is open and willing to learn, examination of these experiences will provide clues as to how existing behaviour can be modified... Unexamined happenings in life are not experiences - merely things which happened and passed without impact." Boud & Walker (1990) believe that a "greater awareness of what is happening in, and a more deliberate interaction with, the learning milieu will provide greater opportunities for a more fruitful learning experience... There is potential for learning in every situation and it is up to the learner to realise this potential.

It is the learner's interaction with the learning milieu which creates the learning experience". Research has, however, revealed that adults tend to be less open-minded (Knowles (1970), people who are not experienced in open appraisal are entrenched in their professional view (Juch 1981) and specialisation can lead to a parochial narrowness of view (Schon 1983).

Problems in learning from experience

Heron (1985) suggests that people acquire a vested interest in not noticing the inadequacies in the face of experience which he terms falsification. Sutton (1983) states that "too often

experience is the barrier to learning". Juch (1981) is of the opinion that few people, without help, are able to realise how and when they learn and which cues trigger off their spontaneous and intuitive thoughts and behaviour. However, relatively little thought seems to have been given to the way in which we learn from our everyday experiences, or to developing methods of helping us to learn more effectively. Boydell (1976) has acknowledged that "A great deal of weight is often given to experience... but in practice experience becomes synonymous with "age" or "length of service"". This is confirmed by the responses to Skitmore's (1985; 1990) surveys. The investigation of how experts react to their experiences is supported by Feldman (1986) who states "the conditions under which experts are more or less likely than novices to learn effectively need further investigation". Lawlor (1983) suggests the clue is feedback from the results of our own actions which is supported by Feldman (1986).

"Ideal" learners

Honey and Mumford (1989a) suggest that ideal learners "often review their experiences; can describe the steps they go through to learn from experience; openly share their experiences; respond flexibly to the unexpected; reach conclusions via careful thought; have detailed recall; can bridge the gap between artificial situations and reality; put deliberate effort

into learning; ask questions; listen patiently; express thoughts fluently; are open to new angles, possibilities; identify their own development needs; can convert ideas into feasible actions; take risks; see connections; ask for feedback; adjust quickly to new, unfamiliar situations; make specific action plans; convert criticism into constructive suggestions for improvement".

Experiential factors and experienced pre-tender estimators

A sample of ten experienced practising pre-tender cost estimators were interviewed to assess whether they were adopting the theoretical aids that improved learning from experience. The interviewees were all corporate members of the Royal Institution of Chartered Surveyors, Quantity Surveying Division and with a mean age of 43.3 years. From the analysis of the interview transcripts the following conclusions were drawn:

Classification of the sample

All the interviewees had a high self-regard for their pre-tender estimating capabilities. Half of the interviewees considered themselves to be 'expert', with the remainder preferring the title 'professional' pre-tender estimator, the terms 'expert' and 'professional' being seeming interchangeable. The sample was therefore assumed to be homogeneous in terms of expertise.

The experience of the interviewees

All the interviewees considered experience to be a contributory factor to their development as estimators. They were initially unable, or reluctant, to give any specific examples of the experiences that had aided their development. After further questioning, however, it was found that the knowledge obtained experientially was thought to relate to the following factors:

*Location - the effects the geographical location of a proposed project have on the pre-tender estimate.

*Clients - the client's likely "preferences and prejudices".

*Architects - the architect's likely "attitudes and preferences".

Most interviewees considered negative experiences to be an effective aid to learning although one interviewee considered positive experience to be equally effective and one considered both to be equally effective.

Application of techniques that would aid experiential learning

The majority of interviewees said they exchanged views with their colleagues concerning the values of their estimates. There was, however, a general lack of objective self assessment and dissemination of information of estimating performance within the interviewees' organisations. The interviewees also had difficulty in adequately explaining how they learnt from experience. None of the interviewees were aware of the potential of experiential learning techniques for improving their estimating performance.

Application of the stages of the Experiential Learning Cycle

The interviewees preferred to adopt analytical and practical approaches, with a general preference for the use of approximate quantities, to preparing estimates for types of projects with which they had little previous experience. There was also a distinct under-utilisation of the reflective stage of the learning cycle.

Openness to change

The interviewees appeared to be complacent and reluctant to change. The factors that were considered most likely to prompt change, and therefore experiential learning, were those of

client dissatisfaction and the introduction of quality assurance.

The working environment

The working environment, for the majority of the interviewees appeared to fall below the ideal described by Honey and Mumford (1989a).

Preferred learning style

In addition to the semi-structured interviews, Kolb's Learning-Style Inventory and Honey and Mumford's Learning Style Questionnaire was administered to the interviewees. The results are described below.

Preferred Learning Style

Figure 1 shows the distribution of the interviewees' learning style preferences based on Kolb's (1979) "Learning Style Type Grid". This distribution is tabulated in Table 2 which compares the data based on the axes of 2.9; 3 (Kolb's mean co-ordinates $n = 1933$), 2.9; 4.5 (Kolb's mean co-ordinates for graduates $n =$

342) and 1.7; 2.8 (the mean co-ordinates for novice quantity surveyors $n = 203$ [Lowe, 1992]).

The preferred learning styles fall predominantly within the opposing quadrants of Assimilator and Accommodator with most of the interviewees favouring the Accommodator style. According to Kolb, the Accommodator is best at concrete experience (CE) and active experimentation (AE). Their greatest strength lies in doing things, carrying out plans and their ability to take risks. They tend to excel in situations where adaptation to specific circumstances is required and they tend to solve problems in an intuitive trial and error manner, relying heavily on other people for information. The Accommodators' educational background is usually in technical or practical fields and they tend to occupy "action-oriented" jobs (Kolb *et al*, 1979)

The distribution of the learning style preferences based on Honey and Mumford's learning style questionnaire is illustrated in Table 3 under their stages of the learning cycle i.e. Activist (CE), Reflector (RO), Theorist (AC) and Pragmatist (AE). The preferred learning style of the interviewees, according to Honey and Mumford, therefore is not as conclusive.

They have a very strong preference for the Theorist style and a strong preference for the Pragmatist and Activist styles and a moderate preference for the Reflector stage. Theorists tend to be perfectionists who like to analyse and synthesise, to adapt and integrate observations into complex but logical theories.

They solve problems in a logical step by step approach and are keen on basic assumptions, principles, theories, models and system thinking (Honey and Mumford, 1989b).

Analysis of the stages of the Learning Cycle

Table 4 summarises the results of the Learning Style Inventory Scores analysis. The Concrete Experience stage of the learning cycle is slightly above the normative mean indicating a tendency for the interviewees to "learn from specific examples in which they can become involved... and benefit most from feedback and discussion with fellow CE learners" (Kolb et al, 1979). The results illustrate a significant increasing reliance by the interviewees on this learning stage compared to the below average score obtained from the novice quantity surveyors. The interviewees low score for Reflective Observation, compared to the normalised mean and the high reliance on reflection by the novice quantity surveyors, represents an under utilisation of this stage of the learning cycle by the interviewees. Their score for the Abstract Conceptualization stage of the learning cycle equates to an average score when compared to the normalised mean. Their highest scoring stage was that of Active Experimentation which is well above the normative average, indicating a tendency to rely upon this style. According to Kolb et al (1979) a high score in active experimentation indicates an active, "doing" orientation to learning that relies

heavily on experimentation and rejects passive learning situations. The scores confirm the declared preference for the interviewees to "do" rather than "reflect" when preparing pre-tender estimates. This compares favourably with the findings of Kolb *et al* (1979) among people with high pressure management jobs whom he found adopt active experimentation learning skills and inhibited reflective observation skills. The scores support the qualitative data generated by the semi-structured interviews. Compared with those obtained from the novice quantity surveyor, these results indicate an increased utilisation of the Concrete Experience stage and a decreased use of the Reflective Observation stage with time.

Table 5 summarises the results compared with the normative averages obtained by Honey and Mumford. These results are not directly comparable with the results obtained using Kolb's Learning-Style Inventory. The range for Honey and Mumford's questionnaire is 0 to 20, whereas for Kolb's inventory the range is 6 to 24. Also the scoring of Honey and Mumford's questions is independent, while Kolb uses a comparative ranking system of 4 word choices. The results confirm the lack of importance shown by the interviewees for the Reflector (RO) stage of the learning cycle which obtained an average score compared to the very strong preference towards the Theorist (AC) stage and a strong preference for the Pragmatist (AE) and Activist (CE) stages of the learning cycle. The mean scores when compared to the normalised scores obtained by Honey and Mumford suggest a

very highly significant preference for the Theorist (AC) stage, a highly significant preference for the Pragmatist (AE) and Activist (CE) stages and no significant difference for the Reflector (RO) stage. While the results do not match exactly those obtained using Kolb's Learning Style Inventory it does indicate again the importance of the Abstract Conceptualization, Active Experimentation and Concrete Experience stages and highlights the low position of Reflective Observation within the interviewees' learning style. When the above results are compared with those obtained by Lansley (1987) for general construction professionals they show a significant increase in the use of the Activist style, a slight increase in the Theorist and Pragmatist styles and a similar result for the Reflector stage.

The scores obtained using Kolb's Learning Style Inventory and Honey and Mumford's Learning Style Questionnaire for the interviewees were compared with other samples within the construction industry i.e. novice quantity surveyors (Lowe, 1992) and general construction professionals (Lansley, 1987). This comparison reveals the following order of significance; Kolb's Learning Style Questionnaire - Concrete Experience (CE), Active Experimentation (AE), Abstract Conceptualisation (AC) and Reflective Observation (RO); Honey and Mumford's Learning Style Questionnaire - Activist (CE), Theorist (AC), Pragmatist (AE) and Reflector (RO). This highlights the importance of Concrete

Experience (CE) and the relative low significance of Reflective Observation by the interviewees.

Analysis of the ranking of individual words, questions and expressions

An analysis of the ranking of the individual words, questions and expressions used in both learning style indicators was undertaken to assess their importance to the interviewees. The common expressions that reflected the preferred learning style are; "practical", "evaluative", "realistic", "experience", "logical" and "pragmatic". The common expressions that least reflected their preferred learning style were; "experimenting", "reflecting", "watching", "intuitive", "observing" and "feeling". Despite the discrepancies in the general definition of the learning style, the analysis of the responses to the individual words, questions and expressions reveals a consistency in their response.

Conclusion

This paper set out to investigate the importance of experiential learning in the development of a quantity surveyor's estimating ability. An analysis is described of interview data obtained from ten experienced practising pre-tender estimators, all with

a high self-regard for their pre-tender estimating capabilities.

The results of this analysis suggest that, for "expert" pre-tender estimators:

- *the preferred learning style, by Kolb's Learning Style Inventory, is that of the Accommodator

- *the preferred learning style, by Honey and Mumford's Learning Style Questionnaire, is uncertain, although there is a very strong preference for the Theorist style and a strong preference for the Pragmatist and Activist styles

- *there is an increasing utilisation of the Concrete Experience stage and a decreasing use of the Reflective Observation stage of the Experiential Learning Cycle with time

- *few use the formal logging of estimates as an aid to reflection

- *all are unaware of, or failed to apply, techniques that would aid learning from experience.

In the light of this last statement and the low overall performance in the Reflective Observation stage of the learning cycle it is likely that specific training on how estimators can learn from experience would be beneficial. This should enable them to capitalise on the learning opportunities present in

their working environments. Introducing estimators to ways of improving their experiential learning should lead to increased feedback and therefore provide a mechanism for improving estimating accuracy. Our review of experiential learning suggests that these could comprise the use of:

- * portfolios - a record of significant learning experiences;
- * journals - a record of self-reflection;
- * discussion with others;
- *debriefing - an opportunity for structured reflection and peer appraisal;
- *collaboration - to facilitate the examination and analysis of uncertainties and dissatisfactions with others;
- *behaviour records - to enable the analysis of the learning situation;
- *reflective analysis - the use of check lists and self-assessment; and
- *convergent thinking - the reflection on divergent aspects and perspectives.

On the evidence presented, it is likely that the introduction of experiential learning theory and techniques into the practice of pre-tender estimating will provide some noticeable improvements in performance. Further research is needed to test this proposition.

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